DECISION RATIONAL DOCUMENT
TOTAL MAXIMUM DAILY LOAD (TMDL)
MUDDY CREEK, VIRGINIA
September 1, 1999

I. Introduction

This document sets forth the Environmental Protection Agency's (EPA) rationale for approving the Total Maximum Daily Load (TMDL) for fecal coliform bacteria for a portion of Muddy Creek. This TMDL was developed by the Virginia Department of Environmental Quality (DEQ), in cooperation with the Virginia Department of Conservation and Recreation. The revised *Final Report, Fecal Coliform TMDL Development for Muddy Creek, Virginia*, dated July 1999, sent July 29, 1999, was received by EPA on August 2, 1999. The revised report is a version of a report originally submitted April 30, 1999, which was modified to address EPA's concerns. EPA has determined that, based on information provided[1], the TMDL meets the following eight regulatory conditions as set forth in 40 CFR § 130:

1. The TMDL is designed to implement applicable water quality standards.
2. The TMDL includes a total allowable load as well as individual waste load allocations and load allocations
3. The TMDL considers the impacts of background pollutant contributions.
4. The TMDL considers critical environmental conditions
5. The TMDL considers seasonal environmental variations.
6. The TMDL includes a margin of safety.
7. The TMDL has been subject to public participation.
8. There is reasonable assurance that the TMDL can be achieved.

In acknowledgement of the need for Federal consistency, EPA .provided a copy of the TMDL report submitted to EPA on May 24, 1999, to the U. S. Fish and Wildlife Service (FWS) for review in consideration of potential impacts to endangered species in the vicinity of Muddy Creek. The June 28, 1999, FWS letter stated, "Based on review of the TMDL development package and the Muddy Creek watershed location, it appears that no impacts to federal listed or proposed species or critical habitat will occur." FWS offered two comments regarding the TMDL, one concerning Virginia's fecal standard, and the other noting FWS's Partners for Fish and Wildlife Program, which offers riparian habitat restoration services for private landowners.

II. Background

The Muddy Creek watershed is located in Rockingham County, Virginia, approximately 10 miles west of Harrisonburg, Virginia. Muddy Creek flows generally north to south, draining a 20,025 acre watershed which is part of the South Fork Shenandoah River basin (Hydrologic Unit 02070005) and is identified in Virginia's waterbody coding system as VAV-B22R. The eastern and central portions of the watershed are dominated by agricultural land uses, primarily poultry and dairy production, while the western-most portion is generally forested. Elevated

[1] EPA considered some supporting information which may be included in the submittal, and in the public docket, but not the TMDL Final Report, in determining its approval.

levels of fecal coliform bacteria in Muddy Creek have been attributed largely to long-term, intensive agricultural activity and can be traced to both direct discharges and storm water-related (non-point source) sources.

Clean Water Act (CWA) Section 303(d) and its implementing regulations require a TMDL to be developed for those water bodies identified as impaired by the State where technology-based and other required controls do not provide for attainment of water quality standards. In its 1998 Section 303(d) list of water quality-limited waters, Virginia DEQ identified Muddy Creek as failing to attain its designated uses as a result of multiple exceedences of the Commonwealth's water quality standard for fecal coliforms and for violations of Virginia's General Biological Standard. This 10.36-mile impaired stream segment begins at the headwaters of Muddy Creek and extends to its confluence with Dry River. A separate 7.04-mile segment of Muddy Creek, together with segments of Dry River and North River, was also identified on Virginia's 1998 Section 303(d) list as being use-impaired based on exceedences of Virginia's drinking water standard for nitrate-nitrogen of 10 mg/l. Virginia is in the process of developing a TMDL for nitrate-nitrogen for that water quality- limited segment.

Virginia developed the fecal coliform TMDL to achieve full compliance with the Commonwealth's water quality standard for fecal coliforms[2]. Table 1 below summarizes the elements of the TMDL.

Table 1. Summary of Fecal Coliform TMDL - Calculated To Average Annual Loading (Counts/Year)

Parameter	$TMDL_{200}$ [a]	WLA	LA	MOS
Fecal Coliforms	9.11×10^{12} [b]	3.04×10^{11} [c]	8.35×10^{12} [d]	4.56×10^{11} [e]

[a] $TMDL_{200}$ represents loading that would correspond to compliance with the 200 count/100ml geometric mean criterion. The MOS, then, is represented as (0.05 TMDLzpp) and affects an approximation of the actual MOS, which was not directly addressed in the loading model.

[b] TMDL = SWLA + SLA + MOS

[c] Derived from Table 5.1 "Wasteload Allocations to Point Sources in the Muddy Creek Watershed" from Virginia's *Fecal Coliform TMDL Development for Muddy Creek, Virginia (July 1999).* Daily loadings were multiplied by 365 days.

[d] Summation of Total annual loads in Tables 5.2 and 5.3 (addressing land-use based on direct nonpoint source loadings in Muddy Creek) from *Fecal Coliform TMDL Development for Muddy Creek, Virginia (July 1999).*

[e] Virginia established a 5% MOS by targeting load reductions to meet a monthly geometric mean of 190 counts/100ml, rather than 200 counts/100ml of fecal coliform. In order to express this MOS explicitly for the purpose of this summary, the loading in Table 1 is calculated based on the equation $TMDL_{200}$ = WLA + LA + (0.05 TMDL200).

Although Muddy Creek was originally placed on Virginia's 1998 303(d) list on the basis of violations of Virginia's instantaneous criterion for fecal coliforms (1000#/100ml), it is

[2] Refer to Virginia Code 9 VAC 25-260-170. Also see further discussion, Section III.1

important to note that Virginia's water quality standard has two situation-specific criteria. Virginia believes that the geometric mean criterion set forth in Virginia's fecal coliform water quality standard (200#/100ml) is the applicable criterion for TMDLs supported by continuous modeling (see section III.1 for more discussion). Therefore, in designing this TMDL to achieve Muddy Creek's full compliance with the water quality standard, Virginia has developed loading models which address the geometric mean criterion. This geometric mean criterion is intended to be evaluated based on a 30-day (or monthly, for practical purposes) assessment period. Virginia has chosen, however, to present overall load allocations for Muddy Creek on the basis of average annual loading. This decision is based on the fact that, due to significant variations in monthly (and daily, for that matter) average flow rates in the watershed, monthly maximum load calculations would not be directly comparable to one another, nor would averaging of these monthly parameters be appropriate. This approach is discussed in greater detail in section III.

III. Discussion of Regulatory Requirements

EPA finds that the TMDL calculated for fecal coliforms in Muddy Creek meets the regulatory requirements of the Clean Water Act. EPA's approval is outlined according to the regulatory requirements listed below.

1. The TMDL is designed to implement the applicable water quality standards

All Virginia waters, including Muddy Creek, are designated for recreational uses (e.g. swimming and boating); propagation and growth of wildlife, including game fish, which might reasonably be expected to inhabit them; wildlife habitat; and the production of edible and marketable natural resources (e.g. fish and shellfish)[3]. Muddy Creek is use-impaired for recreational purposes, based on the fecal coliform colony counts recorded by Virginia's ambient monitoring program.

In order to evaluate the maintenance of the recreational use element of these designated uses, Virginia has adopted a two-part, situation-specific water quality standard for fecal coliforms. The standard requires the use of either an instantaneous maximum criterion (1000#/100ml) if only one sample is available for a 30-day period; or a geometric mean criterion (200#/100ml), in the event that more than one sample is available for a 30-day period. Because of resource constraints, Virginia's ambient monitoring program is generally designed to produce single samples representative of waters in the Commonwealth on a monthly basis. Consequently, Muddy Creek was placed on Virginia's 1998 Section 303(d) list on the basis of significant violations of Virginia's instantaneous criterion (100#/100ml) in the Commonwealth's water quality standard.

Virginia believes, however, that in circumstances where a TMDL is developed for an impaired water body using a continuous modeling methodology, and where adequate data to allow for proper calibration of the model is available, the geometric mean criterion (200#/100ml) is more appropriate to determine compliance with its water quality standard for fecal coliforms.

[3] See 9 VAC 23-260-10

This reasoning is based on several factors: (1) additional field-data points are likely to be generated during TMDL development, (2) continuous modeling provides more than one evaluation opportunity for any give 30-day period, and (3) additional field-level sampling, capable of supporting geometric mean evaluations, is planned to verify implementation of the TMDL. Virginia has chosen, therefore, to develop waste load and load allocations for this TMDL based on compliance with the geometric mean criterion contained in the Commonwealth's water quality standard. In achieving compliance with this criterion, the TMDL will implement the applicable water quality standard.

In order to best accommodate the application of fecal coliform loading calculations toward an evaluation of Virginia's concentration-based water quality standard for fecal coliform bacteria, the Muddy Creek TMDL has been expressed as a Total Maximum Annual Loading. The justification for this approach is discussed below. Extensive modeling was performed to ensure that the selected loading allocations for land uses and direct sources in the Muddy Creek watershed will correspond to 100% compliance with Virginia's concentration-based, geometric mean water quality criterion for fecal coliforms, and Virginia has agreed to initiate a special monitoring program in order to properly evaluate Muddy Creek's future compliance with the geometric mean criterion.

2. The TMDL includes a total allowable load as well as individual waste load allocations and load allocations

Virginia calculated a total maximum allowable load of 9.11×10^{12} fecal coliforms per year from all sources in the Muddy Creek watershed, based on 100% compliance with Virginia's geometric mean water quality standard and the application of a 5% margin of safety (discussed in Section III.6.). The US EPA's BASINS Nonpoint Source Model was selected as the modeling framework to simulate existing hydrologic conditions, existing loadings, and target load allocations. In order to facilitate a more precise understanding of hydrologic processes and governing loading factors, the Muddy Creek watershed was divided into eight sub-watersheds. All land-use related and direct nonpoint sources (Tables 3 and 4) were evaluated for each of the sub-watersheds.

A. Wasteload Allocations

Virginia identified two permitted point sources in the Muddy Creek watershed. One of these permittees, the Mount Clinton school, has never had a recorded discharge and is scheduled for closure in the near future. While the school was determined not to be a significant point source, storm water-related run-off from the facility is addressed in the land-use nonpoint source (NPS) load allocation for the sub-watershed. The second permitted source, Wampler Foods, was determined to be contributing fecal loading at a rate several orders of magnitude below that of most nonpoint sources in the watershed, based on permit conditions. Nevertheless, a WLA was calculated for this single point source, based on available monitoring data and the maximum observed average monthly flow rate. Of the five permitted outfalls identified at the Wampler facility, two are designed as discharge points for collected storm water and are therefore addressed in the development of the land-use NPS load allocation for this sub-watershed. The remaining three permitted outfalls all flow to one discharge point; therefore

average monthly flows and fecal coliform concentrations were aggregated to calculate the facility's WLA.

Table 2. Fecal Coliform Waste Load Allocation, Calculated on a Daily Basis[a].

Point Source	Sub-Watershed	Existing Load	WLA	% Reduction
Mt. Clinton School	Muddy 2	N/A	N/A	0
Wampler Foods, Inc.	Muddy 2	8.34×10^8	8.34×10^8	0

[a]Derived from Table 5.1 "Wasteload Allocations to Point Sources in the Muddy Creek Watershed" from Virginia's *Final Report, Fecal Coliform TMDL Development for Muddy Creek, Virginia (July* 1999).

B. Load Allocations:

Information on deer populations, numbers of cattle and other livestock, and livestock and manure management practices in the Muddy Creek watershed was used to calculate fecal coliform loadings from land-use based, nonpoint sources in each sub-watershed. Total fecal production rates were based on the number of animals present. On-land build-up rates resulting from agronomic application of manure and from direct deposition from grazing livestock were calculated on a monthly basis for each land-use category by sub-watershed. Additionally, "direct" nonpoint sources, such as failing septic systems, uncontrolled and illegal "straight pipes", and time spent by cattle in the stream were represented by discrete loadings. Virginia utilized standard book values and limited sensitivity analysis to arrive at satisfactory estimates for loadings from failing septic systems and other uncontrolled discharges. Virginia Department of Conservation and Recreation (DCR) aided in developing a specific procedure for calculating cattle access to streams in order to estimate the direct loading contribution of cattle in the stream itself. Finally, the calculated build-up rates and "direct" agricultural loadings were also compared with the projected total fecal coliform production rates, using a mass-balance approach, to ensure consistency.

Using the BASINS modeling framework, the following existing annual loads (Tables 3, 4 and 5) were determined, based on the selected five-year modeling period. The existing loads represent the present condition of the watershed. The in-stream fecal coliform concentrations associated with these loading rates corresponded well with Virginia's ambient monitoring program water quality data.

Table 3. Summary of NPS Fecal Coliform Loads By Land Use in Muddy Creek Watershed.

Land Use Category	Fecal Coliforms (average counts/yr)		
	Existing Load[a]	TMDL Load Allocation	% Reduction from current load
Built-Up	1.88×10^{10}	1.88×10^{10}	0
Farmstead	1.78×10^{10}	1.78×10^{10}	0
Forest	7.33×10^{10}	7.33×10^{10}	0
Barren	1.32×10^{8}	1.32×10^{8}	0
Cropland	2.48×10^{11}	2.16×10^{11}	13.1
Loafing Lots	4.11×10^{12}	8.08×10^{11}	80.3
Pasture 1[d]	1.72×10^{12}	1.01×10^{12}	41.3
Pasture 2	2.19×10^{11}	1.28×10^{11}	41.8
Pasture 3	3.34×10^{12}	1.94×10^{12}	42.0
Total	6.74×10^{14}	8.35×10^{12}	98.8

[a] The current load is the summation of build-up values multiplied by the total acreage for each of 8 sub-watersheds.
[b] Pasture lands were divided into three categories, based on manure management practices and grazing intensity. Full explanation of the categorization can be found in Appendix A of Virginia's TMDL report.

Table 4: Summary of "Direct" NPS Fecal Coliform Loads in Muddy Creek Watershed.

Source Category	Fecal Coliforms (average counts/yr)		
	Existing Load	TMDL Load Allocation	% Reduction from current load
In-Stream Cattle	5.82×10^{14}	4.14×10^{12}	99.3
Failing Septic Systems	7.72×10^{11}	0	100
Uncontrolled Discharges	$8.12 \times 10_{13}$	0	100
Total	6.64×10^{14}	4.14×10^{12}	99.4

Table 5: Summary of Combined Load Allocations for Fecal Coliform in Muddy Creek

NPS Source Type	Fecal Coliforms (average counts/yr)		
	Existing Load	TMDL Load Allocation	% Reduction from current load
Land-Use	9.75×10^{12}	4.21×10^{12}	56.8
Direct	6.64×10^{14}	4.14×10^{12}	99.4
Total	6.74×10^{14}	8.35×10^{12}	98.8

[a] The existing load is based on loads calculated for each of eight watersheds.

Examination of Tables 3 through 5 reveals that calculated loadings from "direct" nonpoint sources ranged 2-3 orders of magnitude higher than land-use related loadings. In developing TMDL load allocations for the nonpoint sources, Virginia opted to depend heavily on reducing the contributions of these sources because of the availability of proven and readily available management practices to reduce transport of fecal coliforms to Muddy Creek. For instance, Virginia selected a 99.3% reduction target for fecals loading from cattle actually loafing in the stream itself. This was judged to be desirable based on the assumption that near-complete stream fencing would remove all cattle from the stream, with the exception of specific areas designated as cattle crossings. Similarly, as to contributions from septic systems and straight pipes, Virginia has in place regulations requirement for the discharges to be eliminated. In particular, Virginia's Department of Health regulations state that "(t)he discharge of untreated sewage onto the land or into the waters of the Commonwealth is prohibited."[4] Thus, a 100% reduction target for these source was deemed desirable.

Load allocations to the remaining land-use oriented nonpoint sources resulted in an overall 56.8% load reduction. Because of the high potential for fecal coliform loading from un-managed loafing lots, additional reductions from these sources substantially decrease the necessary reductions from other land-use sources. Since cost-effective management practices and support programs are readily available to address loafing lot loadings, a higher rate of load reduction will be sought for this category. Allocations for cropland and pasture lands were based on assessments of existing and alternative agronomic nutrient/manure management practices. Because their contributions to existing conditions are of much lower magnitude than other land-uses, no reductions were allocated to built-up, barren, farmstead or forested areas.

3. The TMDL considers the impacts of background pollutant contributions

Virginia has identified background loadings as being comprised of loadings from forested land of a baseline background concentration of 30 counts/100ml applied to the entire stream segment.

[4] 12 VAC 5-610-90.A

As can be seen in table 3, above, a specific existing load has been calculated for forested land areas in the watershed. This load is calculated based on wildlife contributions, and is thus considered to be an appropriate measure of "natural loading" in the watershed. Consequently, no load reductions from forested land loadings were considered. Although a calculation of the projected loading from forested land could be used as a baseline loading factor for the entire watershed, this approach was deemed inappropriate. First, it is assumed that the watershed will never be 100% forested. Additionally, although a forested land-use loading factor was established, Virginia did not feel that a suitable, or pristine, forested reference area was available to support such a broad application. Therefore, Virginia selected a generic baseline loading rate of 30 counts/100ml based on the experience of Virginia's contractor, *i.e.,* best professional judgment.

4. The TMDL considers critical environmental conditions

EPA regulations at 40 CFR 13.7(c)(1) require TMDLs to take into account critical conditions for stream flow, loading and water quality parameters. The intent of this requirement is to insure that the water quality is protected during times when it is most vulnerable. The selection of a critical environmental condition also generally corresponds to a specific stream flow condition. This allows for the correlation of total available pollutant loads with in-stream concentrations of the pollutant, when the applicable water quality standard is concentration based.

A single critical condition could not be identified for fecal coliforms in Muddy Creek. Elevated fecal coliform levels were observed over a wide range of flow condition, with general increased in frequency and magnitude observed during both low- and high-flow conditions. These observations support the premise that fecal loading is occurring as the result of both direct release of fecals into the stream, (via straight pipes, uncontrolled discharges, cows loafing in the stream, and permitted point sources), and overland flow into the stream during storm events (from fecal coliform built-up on the land). In order to effectively consider this lack of a single critical condition, Virginia developed a loading factor based on monthly average build-up rates for each land-use category and monthly average "direct" contributions. The monthly average approach was judged appropriate primarily to account for seasonal variations in agricultural practices.

Monthly average stream loading rates from built-up fecal coliforms were then calculated based on the continuous hydrologic data available for the five-year model calibration period. This five-year period which was judged to adequately cover the range of flow and loading scenarios, and thus produce reliable annual loading rates for each land use category.

5. The TMDL considers seasonal variations

Seasonal variations involve changes in stream flow as a result of hydrologic and climatological patterns, and also may reflect changes in local management practices related to pollutant loadings. In the continental United States, seasonally high flow normally occurs during

the colder period of winter and in early spring from snow-melt and spring rains, while seasonally low flow typically occurs during the warmer summer and early fall drought periods[5].

Given the lack of a discrete critical condition, and the significant seasonal variations in flow rates within a watershed such as Muddy Creek, daily or monthly calculations of fecal coliform loads to the stream geared toward compliance with the concentration-based water quality standard, are not directly comparable to one another. In situations such as this one, expressing the load allocations on an annual basis, using field-derived or accepted loading coefficients from the literature, is deemed appropriate to account for seasonal variations.

In calculating the average annual loads, Virginia modeled average loading on a monthly basis. The development of monthly average build-up rates for each land-use and for direct loadings in the Muddy Creek watershed not only allowed Virginia to account for seasonal variations in precipitation and stream flows, but also accommodated the consideration of seasonal management practices relating to fecal coliform loading. For instance, field level surveys around Muddy Creek indicated that farmers generally apply manure only during spring and fall months. Loadings to pasture lands during other months are the product of direct deposition from grazing livestock and wildlife. Additionally, use of the stream channel itself by cattle varies a great deal, depending on the time of the year. These monthly loadings were subsequently summed to provide average annual loadings of fecal coliforms for each source/land use.

6. The TMDL includes a margin of safety

This requirement is intended to add a level of safety to the TMDL-development process to account for any uncertainty. Margins of Safety (MOS) may be implicit, built into the modeling process, or explicit, taken as a percentage or portion of the waste-load allocation, the load allocation, or the TMDLs. Since the applicable endpoint for the fecal coliform TMDL in Muddy Creek is a concentratio-based criterion (200 counts/100ml), Virginia opted for an explicit MOS by reducing the target criterion for modeling purposes by 5% to 190 counts/100ml. The selected TMDL allocation scenario, therefore, never exceeds 190 counts/100ml, as opposed to 200 counts/100ml, calculated as the geometric mean of all samples collected during a given 30-day period.

The bacterial load associated with this MOS can be approximated by the equation:

$$TMDL_{200} = WLA + LA + (0.05\ TMDL_{200}),$$

where the MOS=0.05 $TMDL_{200}$ and $TMDL_{200}$ represents the annual load associated with the 200#/100ml geometric mean criteria in Virginia's water quality standard for fecal coliform.

[5] Section 2.3.3 of the Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1 (EPA 823-B-97-002, 1997).

Solving this equation, the MOS is 4.56×10^{11} counts/year.

Additionally, where loading associated with specific sources could not be readily quantified by direct measurement, or by the available literature, conservative estimates were consistently selected. Thus, an additional MOS is implicit in the model.

7. The TMDL has been subject to public participation

Virginia has developed a standing public notification/public participation process for the development of TMDLs. In keeping with that process, a public meeting, intended to introduce interested parties to an early draft of the TMDL for Muddy Creek, was held in Harrisonburg, VA, on September 16, 1998. This meeting, along with an opportunity for public comment was announced in the *Virginia Register*, and in a local newspaper (the *Harrisonburg Daily News-Record*), and was attended by approximately 85 people. A follow-up public meeting was held at the Mount Clinton School on October 26, 1998, at the request of the County Farm Bureau, and was attended by approximately 250 people.

A third public meeting was held on December 15, 1998, to present the developed TMDL for public comment. The associated public comment period was announced on December 7, 1998, and was eventually extended to March 17, 1999. A final public comment period, reflecting additional revisions to the TMDL was announced in April and closed on May 26, 1999. Virginia received comments from citizens groups, individuals, and interested parties. During this process, the Muddy Creek Citizens Advisory Group was formed with the support of the County Farm Bureau.

8. There is reasonable assurance that the TMDL can be met

Reasonable assurance that the TMDL for Muddy Creek can be achieved can be discussed from two perspectives: (1) the require loading reductions are technically achievable, and (2) adequate resources will be applied to ensure implementation.

Virginia selected the specific source allocations for the preferred load reduction scenario based no only on its belief that the reduction in fecal loadings to Muddy Creek will be protective of human health and meet the fecal coliform standard, but also on the belief that implementation to meet the reduction targets (allocations) for each source is feasible from a practical perspective. While a number of allocation scenarios were considered during development of this TMDL, the final selections ensure the feasibility of this TMDL:

? Although the removal of livestock from riparian areas/streams appears to be the single most significant measure for reducing fecal loading, Virginia refrained from requiring 100% removal of cattle from the streams, to accommodate cattle crossings.

? Virginia depends to a great extent on reductions of loading from barnyard and feedlot runoff, since these sources are controllable via construction of physical flow controls.

? Virginia sought to minimize the reductions to loading associated with agricultural application of manure to crop and pasture lands, given that economically viable alternatives are not yet available.

? Virginia considers 100% removal of loads from failing septic systems and straight pipes reasonable, based on the requirements of Virginia public health laws and VPDES programs.

? Virginia will utilize a phased implementation process, which will allow for evaluation of effectiveness of management practices and refinement of the model, as necessary.

With respect to the phased implementation process, Virginia has identified the reductions in existing loads, in-stream cows, failing septic systems, and uncontrolled discharges, as a Phase I allocation to reduce the WQS violation rate to not more than 10 percent violation of the 1000 count/100ml criterion. At that time, the monitoring program will shift to two or more samples within a 30-day period to demonstrate compliance with the 200 counts/100ml geometric mean. At that time, reductions in fecal coliform bacteria nonpoint source loads from various land uses will be required. This is reasonable in that until the effects of the initial load reductions are reflected in lower fecal coliform counts in Muddy Creek, additional monthly samples will not provide additional information and the cost of sampling is not justified.

With respect to the existence of future resources to adequately support implementation of this TMDL, Virginia State Law (the Water Quality Monitoring, Information and Restoration Act of 1998) requires the development of an implementation plan for all approved TMDLs in the Commonwealth. It is EPA's understanding that such a plan for Muddy Creek will be developed during the remainder of 1999. Virginia presently administers a number of water quality-related programs which will be utilized to support the implementation plan for Muddy Creek.

? The Shenandoah-Potomac Tributary Strategy: While the Strategy is targeted to address nutrient load, most of the prescribed implementation activities address more general agricultural sources of pollution, and thus are applicable to the control of fecal coliforms. Additionally, implementation work in muddy Creek will be coordinated with the results of a nitrate TMDL for Muddy Creek, anticipated for completion by May, 2000.

? Watershed Restoration Action Strategy (WRAS) for the North River area: Virginia has established a "two-tiered" framework for the development of WRASs, as is required by the Federal Clean Water Action Plan of 1999 for high priority watersheds. In combination with the Tributary Strategy, the TMDL implementation plan developed for Muddy Creek will be identified as a WRAS. The completion of this WRAS framework for Muddy Creek will ensure the watershed's eligibility for selective funding associated with the CWAP.

? Because the Muddy Creek watershed has been identified as a high priority watershed by Virginia, significant funding associated with Virginia's Water Quality Improvement Fund, and with Virginia agricultural cost share and incentives programs will be targeted to this watershed.

? The Muddy Creek Citizens Advisory Committee, formed during the winter of 1998-1999, has taken an active role in development of the TMDL and the ensuing implementation plan. The Committee has stated that "….we are ready to improve the quality of the creeks, streams and rivers in our back yards, let us take the lead…"[6]

[6] Letter from Citizens Advisory Committee, via the Rockingham County Farm Bureau, to Virginia DEQ (Charles Martin) dated June 7, 1999.